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13. — *The Variation of Animals and Plants under Domestication.*

BY CHARLES DARWIN. 2 vols. 8vo. New York: Orange Judd & Co. 1868.

THIS treatise forms the first considerable instalment of that more detailed evidence in support of Mr. Darwin's theory of Natural Selection, which he announced in the "*Origin of Species*" to be in course of preparation. It deals only with the facts which have been observed with domesticated organisms, and is soon to be followed by "a second and a third work," which shall discuss the remaining portions of the subject. The reputation of the author will certainly not be diminished by these two volumes. The labor in the collection of facts, the sagacity shown in their interpretation, and the amount of patient thinking involved in the final use made of them, are equally great and admirable. It is indeed a real pleasure, at a time when so much of scientific industry consists of a mere mechanical cataloguing of immediate results, to read a work like this, — even though we may not feel like agreeing with its results, — which is thoroughly and elaborately composed, and has a beginning, a middle, and an end. The first volume is devoted to a review of the history of the most important domestic animal and vegetable kinds, and the manner and limits of variation in each. The general result of this inquiry is a conviction of the endlessly fluctuating character, or, to use Mr. Darwin's words, of the "plasticity of the whole organization." In the second volume he discusses various general problems connected with the subject of Variability and Inheritance, basing his conclusions on a large number of additional facts, as well as on those already given in the first part.

We may briefly indicate a few of the more important propositions arrived at in this second part. The first three chapters treat of Inheritance generally and Atavism. The author comes to the conclusion that every character of the parent, whether new or old, tends to be reproduced in the offspring either in a patent or a latent form. By latent characters he means such as may appear in the individual only after a certain age, as, for instance, the beard in man; or such as commonly do not appear in the individual in question, but are occasionally from unknown causes developed, as the "secondary" characters of the opposite sex (e. g. comb, spurs, voice) in many aged hen-birds, and those of the female sex in castrated males generally. "Atavism" gives us a third variety, — where, after being dormant during whole generations, an ancestral mark suddenly shows itself. Mr. Darwin's generalizations in these chapters simplify considerably the whole subject; and he even attempts a physical explanation of the latent transmission of characters,

of which we shall presently speak. The unknown causes which counteract the tendency in the progeny to reproduce the parent exactly are touched upon in the chapters on variability.

One of the weightiest objections to the hypothesis that the natural selection of varieties having advantageous characteristics is the cause of the diversity of existing organism, lies in the almost universal prevalence of sexuality. How can it ever have tended to insure the survival of a breed, to have its propagation dependent on the conjunction of two individuals? At first sight it seems obvious that any breed of creatures in which each individual had the power of producing young without foreign assistance, would, other things being equal, run far less risk of permanent annihilation, than where two parents were required. And yet we see even in vegetables, where bud-propagation is possible, a sexual form of reproduction superadded, which, although commonly hermaphrodite, yet in a vast number of cases requires the concurrence of two separate flowers or plants. If these facts be due to natural selection, one is tempted to exclaim, then natural selection is capable of heaping up difficulties in the way of the subsistence of specific forms! To account by the principles of natural selection, as Darwin understands it, for the existence of such a law, we must be able to prove that when two distinct individuals contribute to form the germ, they communicate to it some property of vigor or viability, which in the long run more than compensates for that greater immediate fecundity which would obtain in a family whose members were capable of multiplying singly and separately. And this proof Mr. Darwin has attempted to furnish. He has shown, by a large body of evidence, including some important observations of his own on plants, that the crossing of breeds and individuals, animal or vegetable, actually does have a beneficial effect on the offspring. Every breeder of chosen strains of domestic animals has been obliged, from time to time, to infuse some foreign blood, even at the cost of deterioration in purity of form, to prevent the continual tendency which exists to sterility and delicacy of constitution. In plants a large number of facts are given, showing that when individuals and varieties are crossed, the offspring show an immediate superiority in size, strength, and fertility over those of hermaphrodite unions. In fact, the evidence here seems almost absurd and excessive, for we hear of plants which require a different *species* from their own to fertilize them at all, and others whose own pollen poisons them. Whatever may be said of these last abnormal cases, the author is of opinion that, even in hermaphrodite plants, Nature makes provision in every instance, though sometimes at distant intervals, for the meeting of the pollen and stigma of separate individuals. The physiological causes of this necessity are to-

tally obscure. Is it that, by joining individuals of different parentage, we eliminate from the organism of the offspring seeds of disease, weak spots due to the assaults of an unfriendly outward nature, which, if allowed to accumulate from generation to generation, would finally be ruinous? Mr. Darwin is inclined to think this is not the cause; although it has been considered by many authors that peculiarities of recent acquisition and confined to one parent (such as these morbid tendencies would be) are inclined to disappear or be absorbed by characters of long standing and common to both progenitors (such as those typical of the group in a healthy condition). We must, according to Darwin, rather assume that, in the case of long-continued hermaphroditic generation, the deleterious moment is to be sought in the absence of a healthy stimulus rather than in the presence of a too monotonously depressing influence from without. The tendency to lose vigor seems inherent in the forces of the organism itself, and needs to be combated by a refreshing of the external conditions, "as a fire will go out, unless poked."

Again, "slight changes in the conditions of life" of a race of animals or plants seem to have the same beneficial effect as a less close interbreeding. A change of pasture or soil may stave off deterioration in the same way as a change of "blood." From this we proceed to another important point. *Hybrids*, or the offspring of "species" in nature, are almost invariably sterile. While *mongrels*, or the progeny of "varieties," are, as we have seen, very fertile. Our direct observation of change in organisms extends at most to the origin of varieties. When Mr. Darwin proposes to extend the results of it to species, and says they are nothing else than more developed varieties, he is met by the very pertinent objection: "Whence arises the sudden sterility in species? Your generalizations cannot stand unless you show an historical case of two varieties diverging from a single ancestor and losing their fecundity *inter se*." Mr. Darwin endeavors now to weaken the force of this objection by proving, in a general manner, that sterility depends on very various and often very slight causes, and may have been brought about incidentally to other changes useful to the species; for being of no conceivable use itself, it can hardly have been "selected" by nature. He shows, in a long and able chapter, that, just as we have seen slight changes of habitat and blood to be equally beneficial, so there are in each case limits to the good effect, and a too abrupt alteration of the mode of life (as from freedom to captivity in wild animals), or a crossing of kinds which are too incongruous, alike give rise to sterility; which, he then concludes, is due in all cases to local changes in the reproductive organs. His chief illustration in support of this position is drawn from what are called di- and tri-morphic plants.

These (we take the dimorphic kind for the sake of simplicity) are plants with two sorts of flowers that differ in nothing but their reproductive organs, "one form having a long pistil with short stamens, another form a short pistil with long stamens; both with differently sized pollen grains." Now the pistils and stamens of different lengths (i. e. of the same flower) are always more or less sterile *inter se*, — so that we have what he calls a condition of "hybridity produced within the limits of the species." Here we may certainly admit that the cause of sterility lies exclusively in the reproductive system. But it is a single fact, and an anomalous one at that, and what a generalization is to be made from it! He brings, it is true, other cases to its support, namely, that the degree of sterility is not inversely as the systematic affinity, and that it is often not the same when crosses are "reciprocally" made; that is, when, for instance, the pollen of A is brought upon the stigma of B, the fertility may be greater than when the pollen of B is put upon the stigma of A, which can only be accounted for by supposing either the pollen of B or the ovules of A to be more differentiated than the two other sexual elements. But we may still ask, If we are to assume that the sterility of species *inter se* is owing to changes in their reproductive organs, — which changes have arisen incidentally to a number of other changes in the organisms in question, — how comes it that in our domestic kinds (which differ avowedly much more than many wild species) it is totally absent? It is not then incidental to *all* change. Why should it just happen to have been incidental to those changes that have made wild species what they are, and not at all to those to which we owe our domesticated kinds? Mr. Darwin's reply to this is found in what he calls the Pallasian doctrine, that the influence of domestication in itself increases fertility, and even confers it in cases where it is naturally absent. This doctrine is mysterious enough (unless, indeed, the fact be due to selection, but that seems improbable in the case of the latter half of the law), and we cannot think the matter as yet cleared up. Although if more examples of wild species fertile together should be found, as some have been already, and more of domestic varieties with an incipient tendency to barrenness, of which Mr. Darwin gives a list in Chapter XV., the difficulty will be much diminished.

Five chapters of the book are devoted to a study of variability in itself, its laws and its causes, — a subject of extreme importance in a physiological point of view, and one of the two prime factors in Darwin's theory, which supposes variability to produce at random different points and qualities, and that the superior fitness of certain of these singles out their possessors to survive and gradually crowd out and

supplant other rival forms. We cannot say that we think the author does much in the work of penetrating the dense veil that covers the subject, though by various minor generalizations and groupings of facts he makes the matter somewhat more easy to handle. He considers that the remote cause of variability is to be looked for in changed external conditions of almost any sort (e. g. excess of food), as well as in crossing (though here its phenomena are obscured by the commingling of parental characters, and by a distinct tendency to atavism which the act of crossing seems to call forth). But the nearer causes which determine the particular form of the variation one cannot even guess at. We can only say, the parent organism, and consequently the reproductive system, receives a sort of commotion, which causes its elements to combine in unwonted ways, but the particular source of the shock is a vanishing moment in the determination of the result compared with the precise condition of the elements which receive it. The vagueness of all speculation here is obvious. One fact seems to our author certain, that change of medium is not, as some authors have supposed, in general more likely to produce a habit of body in the offspring better suited to the new medium than it is to produce the reverse habit. Though here, as elsewhere, a number of exceptions are to be found.

In a chapter entitled "Provisional Hypothesis of Pangenesis," the author proposes a theory for binding together all the different modes of reproduction, regeneration of lost parts, latent characters, atavism, &c., &c., in a manner that shall make them physically intelligible. The same combination of bold surmise and delicate ingenuity is shown here, as elsewhere; but we have no space to analyze the hypotheses, nor do we think it, to tell the truth, of much importance; for, in the present state of science, it seems impossible to bring it to an experimental test.

The one strong impression that affects the reader, after laying down these volumes, is that of the endless complication of the phenomena in question, and the (perhaps hopeless) subtlety and occultness of the immediate causes. At the first glance, the only "law" under which the greater mass of the facts the author has brought together can be grouped seems to be that of Caprice, — caprice in inheriting, caprice in transmitting, caprice everywhere, in turn. To look for laws at all in the chaos seems absurdly presumptuous. How many "laws," and lawgivers, too, has natural history sent to her limbo? Still, a beginning must be made, and although the so-called laws be based on knowledge the vaguest and farthest removed from the elementary causes at work, yet they are useful; for a bad hypothesis is far better to work

with than none at all. There is hardly a single "law" promulgated or quoted by Mr. Darwin, which has not numerous inexplicable exceptions. It is, for instance, a law, that cross-bred animals vary and revert; but on p. 97 of Vol. II. a whole list is given of "true" breeds having arisen from crosses. It is a law, that domestication gives fertility, — why not in the peahen and variation, why not in the goose? That plants of different species are more *sterile inter se* than plants of the same species, — why not, then, in *Passifloræ*; and so on, almost *ad libitum*? We can only say, exception, idiosyncrasy. But this only shows how far we are from the elementary phenomena to be studied. Who can attempt to analyze the causal moments involved in the word "domestication"? And even when the existence of a "law" is pretty certain, how can we be sure whether particular facts are instances of it or not? For example, Mr. Darwin seems to think, in one place, that the existence of extra fingers, in certain men, may be due to reversion, away back of the salamanders, to a fish-like ancestor; and elsewhere, that the case of a woman, with a breast developed in the groin, should be interpreted as a return to the cow-like condition of some antique progenitress. But it seems, to say the least, as reasonable to look on these as new and original variations.

Of course, these are all truisms, which Mr. Darwin knows as well or better than any one else. It is one of the fortunate points of the general theory which bears his name (and which is, after all, only a descriptive or historical, and not a physiological hypothesis), that the more idiosyncrasies are found, the more the probabilities in its favor grow. Its adversaries are those whose interest it is to establish the rigor of these descriptive laws. For, the power of natural selection being, in principle, acknowledged, and the foregone half of eternity being allowed for it to work in, all that the logic of the theory demands is, that *some* cases of variation in the direction of the facts observed arise. A great number of contrary cases would not (at least, in the present stage of science) be antagonistic, but only *waste* matter. Hence, the great value of the hypotheses in setting naturalists to work, and sharpening their eyes for new facts and relations. The present book harrows and refreshes, as it were, the whole field of which it treats. It is, doubtless, provisional, but none the less serviceable for that, and we cordially recommend it to the student. The popular reader will be likely to find it much more special, and less interesting, than was the "Origin of Species."

A word of praise must be bestowed on the admirable Index, which occupies fifty pages, and is, at the same time, a shining example and a reproach to all those lazy, undutiful book-makers among us, who are

wont to neglect their readers' legitimate demands in this direction. It should be mentioned, also, that the American reprint contains later notes and corrections by the author, and an introduction by Professor Gray.

14. — *Man's Origin and Destiny sketched from the Platform of the Sciences, in a Course of Lectures delivered before the Lowell Institute, in Boston, in the Winter of 1865-66.* By J. P. LESLEY, etc., etc. Philadelphia: J. B. Lippincott & Co. 1868. 8vo. pp. vi., 384.

A MORE correct idea of the contents of this work than is suggested by its title may be drawn from the headings of its chapters, or lectures, which are as follows: 1. On the Classification of the Sciences; 2. On the Genius of the Physical Sciences, Ancient and Modern; 3. The Geological Antiquity of Man; 4. On the Dignity of Mankind; 5. On the Unity of Mankind; 6. On the Early Social Life of Man; 7. On Language as a Test of Race; 8. The Origin of Architecture; 9. The Growth of the Alphabet; 10. The Four Types of Religious Worship; 11. On Arkite Symbolism. The course appears reduced from its normal number of twelve lectures, by the force of imperious circumstances; the tenth and eleventh were stretched in the delivery to two each, and their successor sacrificed, having never been written out. Its retention, Mr. Lesley tells us, would have helped to justify the title; seeing, as we interpret it, that the work in its present form hardly deals with the destiny of man at all. Its unity has further suffered from the interpolations made necessary by the new discoveries and the new views of the two years that elapsed between the original delivery and the publication. It is a somewhat desultory series of disquisitions on man in general, especially on the beginnings and early development of some of his more important institutions. It includes a conspectus of the geological and archæological evidence on which the present generation is beginning to found its belief that its ancestors are vastly older than has been generally supposed. This evidence has to be rehearsed again and again, set in every light, and supported by every variety of illustration, in order to prevail over the conservatism of ancient opinion, fortified by supposed religious sanctions. But as the truths of geology have made their way to the acceptance of all cultivated and enlightened men, in spite of these opposing influences, so, we presume, will those of anthropology also, so far as they shall maintain themselves as truths before reiterated examination, friendly and hostile; and in its contribution toward this result lies the chief value of Mr. Lesley's work. In his mode of presentation, however, there is not much which is calculated to win over the adverse